Available Online
Journal of Economic Impact
ISSN: 2664-9764 (Online), 2664-9756 (Print)
http://www.scienceimpactpub.com/jei

DOES LAFFER CURVE EXIST IN TAX STRUCTURE OF PAKISTAN? A THRESHOLD REGRESSION ANALYSIS

Khalid Mehmood [a,*], Sajjad Ahmad [b], Tariq Mehmood [c], Muhammad Mohsin [d], Muhammad Ishfaq [e]

[a] *Adaptive Research Farm, Sargodha, Directorate General Agriculture (Extension and Adaptive Research), Government of Punjab, Pakistan*
[b] *Department of Economics, University of Sargodha, Punjab, Pakistan*
[c] *Directorate of Agriculture (Economics & Marketing), Government of Punjab, Pakistan*
[d] *Pakistan Science Foundation, Islamabad, Pakistan*
[e] *Directorate of Agriculture Coordination (Farms, Training & Adaptive Research), Punjab, Lahore, Pakistan*

ARTICLE INFO

Article history
Received: December 02, 2021
Revised: February 25, 2022
Accepted: February 28, 2022

Keywords
Laffer curve
Tax rate
Direct tax
Corporate income tax
Threshold regression

ABSTRACT

Laffer curve is a trade-off between tax cuts and tax revenues. The study implies threshold regression to test the existence of the Laffer curve in Pakistan's economy using time series data for a period of thirty years (1991-2020). The linear association between tax cuts and tax revenues was assessed using simple ordinary least squares technique. The tax structure of Pakistan mainly constitutes two components, direct and indirect taxes. This study examined nature of the Laffer curve using data on direct tax revenue and corporate tax rate. The study supported the evidence of the Laffer curve with a threshold tax rate of 26%. The existing corporate income tax rate in Pakistan is 29% which lies in prohibitive range of the Laffer curve. As a policy measure, the corporate tax rate is recommended to be reduced at least up to the threshold level in order to bring the maximum number of tax evaders and elites under the tax net to enhance the tax revenues of Pakistan.

* *Email: khalid7880@yahoo.com*
https://doi.org/10.52223/jei4012217

INTRODUCTION

The Laffer curve is basically a theoretical association between tax rates and the consequent amounts of tax revenues received by the government (Fullerton, 1983; Latif et al., 2019). The theory of the Laffer curve was developed by the supply-side economist Arthur Laffer in 1974. It assumes zero tax revenue generated at the extrema of tax rates (Bender, 1984). The Laffer curve is normally illustrated as a graph that initiates from 0% tax rate with no tax revenue, increases to a maximum level of tax revenue at a midway tax rate, and then drops down to zero tax revenue at a 100% tax rate. However, the economists differ in their views about the shape of Laffer curve which is controversial and uncertain among them (Tucker, 2010). The Laffer curve follows Rolle's theorem as it is assumed that revenue is the continuous function of the tax rate (Gahvari, 1989; Meyer, 2012).

The literature largely supports the concept of Laffer curve which describes that the tax revenues can be boosted up through tax cuts (Smith, 1776; Takáts and Papp, 2008; Bunescu and Comaniciu, 2013; Holter et al., 2014; Tatu, 2014; Isakov and Pekarski, 2015). But, the rise in tax revenues due to a fall in tax rates is limited up to a certain level of tax rate or upper fiscal limit. If the tax rates are above the specified limit, it implies that the economy is operating in the prohibitive area of the curve (De Oliveira and Costa, 2015). Laffer curve is more effective to raise the income as compared to progressive taxation (Holter et al., 2014). Hsing (1996) studied four different functional forms of Laffer curve for the U.S economy using annual data (1959-91) of personal income tax rate thereby specifying a quadratic function and found that linear and log-log regression functions showed better results than the semi-log functions.

Hairault et al. (2005) made use of Laffer curve to study the trade-off between incentives for delayed retirement and little increase in pension to mitigate the deficit using French data; and suggested that administration may encourage the employees to delay their retirements by offering attractive allowances or to set minimum amounts of pension after their retirements. Bachvarova (2008) analyzed the data of 127 small developing countries for the period of 1990-2005 and found that Laffer curve helped during debt pressure conditions because many small countries did not have many resources for investment. Moreover, the effect of Laffer curve was also distorted by the political instability in countries. Uhlig and Trabandt (2011) studied the Laffer curve for fifteen selected states of the European Union and concluded that tax cut could improve the tax revenue to the extent much greater than that in USA. Nutahara (2013) sketched the Laffer curve for Japan's economy and recommended that government might follow the

strategy of Laffer to enhance the tax revenue by decreasing the taxes on capital but increasing taxes in labour market. The countries with high debt to GDP ratio, like Japan, are quite suitable to increase the revenues by tax cuts.

Latif et al. (2019) proved the existence of Laffer curve on the basis of taxes on goods and services for the period of 1981 to 2018 and concluded that existing tax rates were prevailing within the prohibitive area of the curve in Pakistan. However, some caveats exist in the study of Latif et al. (2019) wherein total tax revenue (% of GDP) was used as dependent variable rather than the revenue obtained from only indirect-taxes. On the other side, tax amount on goods and services (% of total tax revenue) was used as an explanatory variable rather than using the tax rate levied on goods and services. The nature of variables chose contradicted with the basic theory of Laffer curve.

Laffer curve, as a tool of taxation, helps in alleviating the fiscal deficit (Tatu, 2014). The theory also holds at its best in recession periods when economies need appropriate fiscal policies to be cured (Isakov and Pekarski, 2015). Chakraborty (2015) also asserted that the Laffer curve could serve as an effective instrument to offload the fiscal deficits in developing countries. Van Ravestein and Vijlbrief (1988) derived a Laffer curve for Netherland's economy and found that the increase in tax revenue by enhancing tax rate incurs a welfare loss to the economy.

The tax system of Pakistan is not as much efficient and effective as that in developed economies (Latif et al., 2019). A number of loopholes exist in the tax regime of Pakistan, which can be treated to the great extent by employing the Laffer curve as a revenue increasing tool. Every year, Pakistan faces a high deficit to budget ratio at national as well as international levels in terms of loans from foreign funding organizations (World Bank and IMF, etc.) at high interest rates. It also averts the attention of foreign investors to make investments in Pakistan. Laffer curve may serve as a partial solution to the existing grim situation through adjustment of tax rates in such a way that maximum number of tax avoiders and elites could be brought under the tax net. Lucas Jr (1990) supported the supply-side economists and recommended to follow them in tax systems of developing countries.

The paper in hand is aimed at studying the Laffer curve in the context of Pakistan thereby depicting the relationship between tax rates and resulting revenues received by the government. The earlier literature lacks the estimation of Laffer curve in the context of Pakistan particularly using the revenues received from direct taxes and corporate income tax rates. The two basic modules of Federal tax revenues are direct taxes (income tax received from corporations and individuals and taxes on capital values) and indirect taxes (general sales tax, customs and excise duties). Indirect taxes are considered to be regressive in nature because their pressure is transmitted or forwarded to the end consumers. The direct taxes, on the other hand, are generally considered to be progressive and can help upholding the overall proportionality of the tax systems. The direct (or income) taxes have a vital role in sustainability of the economic growth and development of an economy. Historically, the direct tax remained a major contributor in total tax revenues. According to the recent annual report of FBR (2018-19) approximately, 38 % of total tax revenue of Pakistan is received from direct taxes. Moreover, corporate income taxes have large share in the direct tax revenues. So, this study focused the corporate sector of Pakistan's economy and the revenue maximizing corporate tax rate has been worked out using threshold regression analysis.

The objectives of the study are: 1) to study the applicability of Laffer curve in Pakistan, 2) to study the impact of tax cuts on tax revenues in Pakistan, and 3) to work out the optimum level of corporate tax rate in Pakistan using threshold regression analysis. Rest of the paper is organized as follows: the second section deals with methodology, followed by the third section of results and discussion, and the fourth section concludes the paper.

METHODOLOGY

Data

The study used time series secondary data for the period 1991-2020 in order to achieve the research objectives. The data on tax revenues, corporate tax rates and GDP were retrieved from the Ministry of Finance, Government of Pakistan and the various periodicals of annual reports of the Federal Board of Revenue (FBR) Pakistan. The data analysis was performed using R-software version 4.0.3 (Team, 2020). Descriptive statistics such as mean, minimum, maximum, frequency, standard deviation and percentage were used to assess the multivariate trends in data.

Methods

Firstly, the linear association between tax cuts and tax revenues was assessed using simple ordinary least squares technique. The model is given as:

$$Rev_t = \alpha_0 + \alpha_1 T_t + \in_t \quad (1)$$

Where, subscript 't' shows the relevant time period (year), *Rev* is the corporate tax revenue as the percentage of GDP, α_0 is the intercept term, α_1 is the slope coefficient of tax rate, T is corporate income tax rate and $\in$ is the residual term. Model 1 explains how much tax revenue will be increased or decreased by changing the tax rate to a certain level.

Hsing (1996) constructed four quadratic types of models to derive Laffer curve for U.S economy: linear model, log-log model, lin-log model and log-lin model; and found that linear and log-log models yielded better results as compared to the semi-log models. Following the literature (Hsing, 1996; Latif et al., 2019), we estimated Laffer curve using a threshold regression model. In threshold regression, the predictors are regressed on the outcome variable in a threshold based process. When a threshold parameter is incorporated into regression, the model provides a simple but sophisticated and more interpretable way to estimate different types of nonlinear associations between the variables (Pastor-Barriuso et al., 2003). Threshold parameter is also termed as the change point. Threshold regression model is given below:

$$Rev_t = \beta_1 T_t + \beta_2 {T_t}^2 + \in_t \quad (2)$$

It is important to mention that the above model is the regression through origin, i.e., the intercept term has not been included in the model as it makes no sense. When there is a zero percentage tax rate, there will ultimately be zero tax revenue (Hsing, 1996). Following the study of Latif *et al.* (2019), we also incorporated the lagged dependent variable (Rev_{t-1}) in the model in order to

address the problem of autocorrelation. Thus, the threshold regression model was used in the following form:

$$Rev_t = \beta_1 T_t + \beta_1 T_t^2 + Rev_{t-1} + \in_t \quad (3)$$

Stationarity of the data and autocorrelation were tested through Augmented Dickey Fuller (ADF) test and Durbin Watson (DW) test, respectively. The outcome models were compared through AIC and BIC test statistics. The following hypotheses were postulated based on the objectives of the study:

Hypothesis 1

H_0: $\alpha_1 = 0$ (There is no linear association between corporate tax rate and direct tax revenue).

H_1: $\alpha_1 < 0$ (There is a negative linear association between corporate tax rate and direct tax revenue).

Hypothesis 2

H_0: $\beta_1 = \beta_2 = 0$ (Laffer curve does not exist in tax system of Pakistan).

H_1: $\beta_1 > 0 > \beta_2$ (Laffer curve exists).

RESULTS AND DISCUSSION

Stationarity Diagnosis

Time series data often encounters the problem of non-stationarity (Griffiths et al., 1993; Gujarati, 2009; Dougherty, 2016). The ADF unit root test results showed that the data was stationary at level (Table 1).

Figure 1 illustrates the trends of corporate tax rates and tax revenues as % of GDP in Pakistan. Mostly, the corporate tax rate remained in the range of 30% to 35%. However, there was a large jump from 35% in 1999 to 43% in 2000. Correspondingly, there was a large cut in tax revenue as % of GDP from 3.75% in 1999 to 2.66 in 2000. After 2000, the corporate income tax rate gradually decreased might be due to the reason that the government had realized that tax cuts could increase the tax revenues. The corporate tax revenue (as a % of GDP) has increased gradually over time.

Table 1. ADF Test Results.

Time Series	Lag order	ADF Test Statistic	p-value	Result
Corporate Tax Rate	2	- 4.134	0.019	Stationary
Tax Revenue (% of GDP)	2	- 4.279	0.013	Stationary

Note: Alternative hypothesis: Stationary (Source: Authors own calculations).

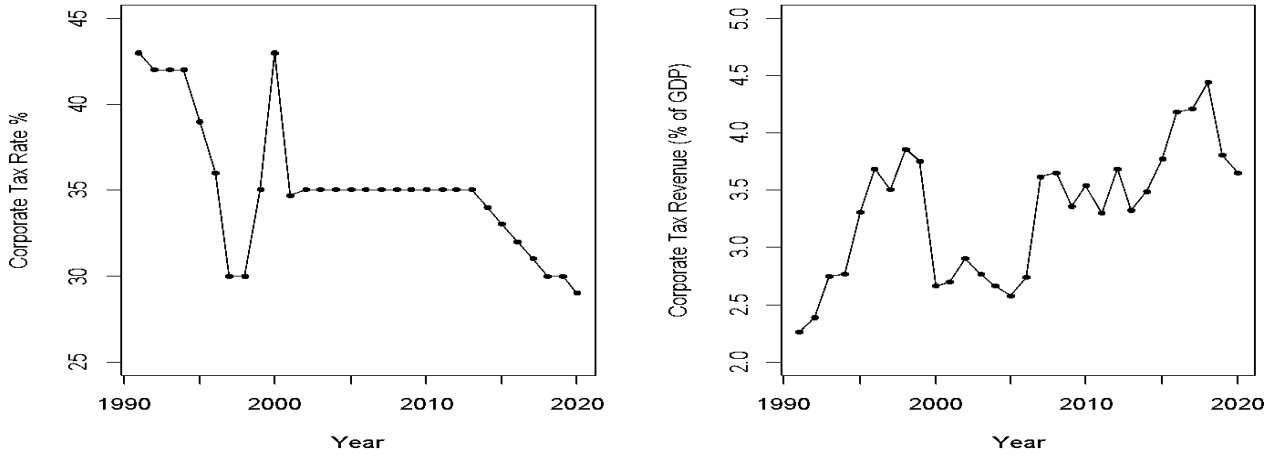

Figure 1. Graphical Illustration of Tax Rates and Tax Revenues in Pakistan (1991-2020).

Descriptive Summary

Table 2 presents the descriptive statistics of the data used in the analysis. Results show that from 1991 to 2020, minimum, average and maximum corporate tax rates in Pakistan were 29, 35 and 43 percent, respectively. Similarly, minimum, average and maximum tax revenues (% of GDP) were 2.25, 3.31 and 4.44 percent, respectively. The standard deviations for tax rate and tax revenue were 3.97 and 0.58, respectively.

Linear & Non-Linear Models

The results of linear and non-linear models are presented in Table 3. The negative sign of tax rate in linear model depicts that tax cuts significantly enhanced the tax revenues which confines us to the conclusion that null hypothesis is rejected in case of the first hypothesis. The R-square value is low in linear model, suggesting that the model captures only 62% of the variation in response variable due to explanatory variables.

Non-Linear model (NLM)-I captures the quadratic relationship between tax rate and tax revenues. The coefficient of tax rate is significantly positive and that of squared tax rate is significantly negative, showing that there exists a level of tax rate where tax revenues are maximized. Hence, we reject null hypothesis in case of second hypothesis. The value of R-square is quite high (0.98) which shows that model is fitted better than the previous one. But, here we encountered the problem of autocorrelation as depicted from DW-statistic 0.746, which is quite significant. Therefore, the lagged dependent variable was included in the model to capture the effect of endogeneity. The signs of estimated parameters are according to the theory (Hsing, 1996; Latif et al., 2019).

Table 2. Descriptive Statistics of Corporate Tax Data in Pakistan (1991-2020).

Variable	Minimum	Mean	Maximum	Std. Deviation
Corporate Tax Rate (%)	29	35.19	43	3.970
Tax Revenue (%of GDP)	2.25	3.308	4.44	0.578

Source: Authors own calculations.

Table 3. Results of Threshold Regression Models for Laffer curve in Pakistan.

Variable	Units	Linear Model	Non-Linear Model (I)	Non-Linear Model (II)
Intercept	-	35.111 *** (4.03)	-	-
T_t (Tax rate)	%	-0.784 *** (0.11)	0.283 *** (0.02)	0.123 * (0.04)
T_t^2	%	-	-0.005 *** (0.001)	-0.002 * (0.001)
Rev_{t-1}	% of GDP	-	-	0.607 *** (0.14)
Adjusted R^2		0.62	0.98	0.99
F- Statistic		47.40 ***	934.40 ***	971.90 ***
N (Observations)		30 [1991 - 2020]	30 [1991 - 2020]	30 [1991 - 2020]
DW- Statistic		0.802 ***	0.746 ***	1.773
AIC		142.48	37.31	23.22
BIC		146.68	41.52	28.68
Threshold (optimal) tax rate (r)		-	26.68 %	25.54 %

Note: S.E reported after the coefficients in parenthesis; Significance Codes: '***' = 0.01 '**' = 0.05 '*' = 0.1.

The coefficient of lagged dependent variable is positive and highly significant. The value of DW-test statistic was 1.773 (with p-value 0.122) for NLM-II and the R-square value was also very high. The results confirmed that NLM-II with lagged dependent variable bears the lowest values of AIC and BIC as compared to the other two models. Hence, NLM-II offers the best fit and the most reliable results.

The Laffer curves derived from the NLM-I (smooth curve) and NLM-II (dotted curve) are illustrated in Figure 2 that is sketched on the basis of hypothetical values of tax rates ranging from 0% to 100%. The threshold optimal tax rate is 26.68% for NLM-I, and 25.54% for NLM-II. Currently, Pakistan is operating at 29% corporate tax which is about 3.5% higher than threshold revenue maximizing rate. Similar curves were drawn for the economy of China (Lin and Jia, 2019). The results of quadratic equations support the outcomes of Hsing (1996). The study infers that Pakistan's corporate tax rate is operating in prohibitive range of the Laffer curve. The research outcomes are also in accordance to those of Latif et al. (2019) which concluded that Laffer curve exists in Pakistan's tax structure but in the prohibitive area of curve.

During the past two decades, tax to GDP ratio remained very low despite of numerous efforts made by governments, mainly due to the factors such as distortionary tax concessions and exemptions, fragile enforcement of tax laws, non-compliance in paying taxes on a large scale, greater share of indirect taxes as compared to the direct taxes, persistently narrow tax base and weak administration in tax system of Pakistan. There are a few sectors under taxation, many sectors partially taxed and some absolutely not taxed in Pakistan. This unfair distribution and contribution of taxes caused a low tax to GDP ratio and narrow tax base over the history in Pakistan. Levying the high tax rates is not a solution to low tax to GDP ratio but remedying the other pitfalls in the present tax system is crucial.

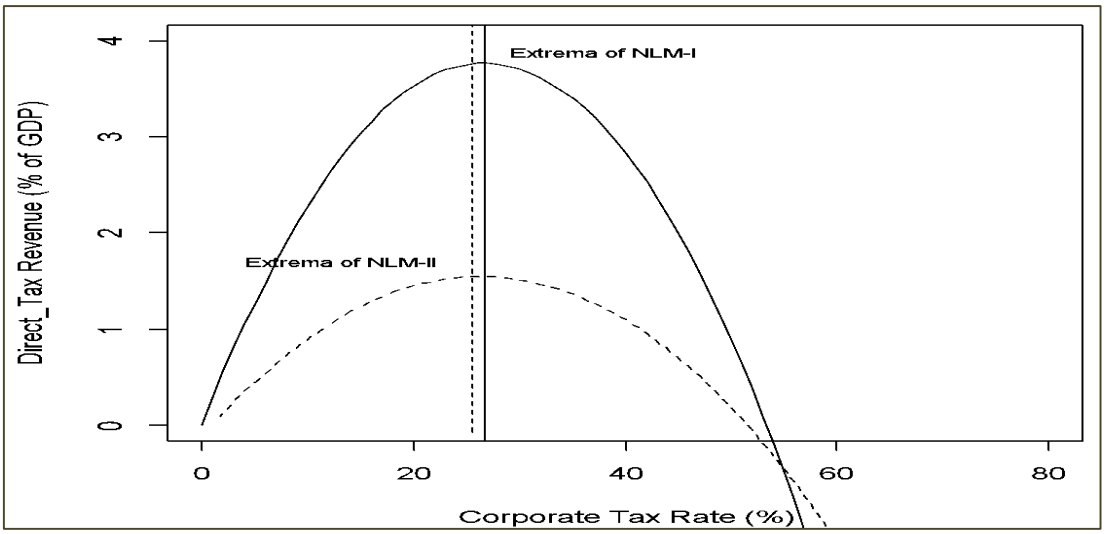

Figure 2. Hypothetical Laffer curves for Pakistan's tax system (1991-2020).

CONCLUSIONS

The direct (or income) tax has a vital role in sustainability of the economic growth and development of an economy. The study confines to the inference that Laffer curve holds in Pakistan's tax system. The threshold regression suggested the revenue maximizing tax rates of 26.68% and 25.54% for two separate models, whereas the existing corporate income tax rate in Pakistan is 29% which lies in the prohibitive range of Laffer curve. It is suggested to reduce the corporate income tax rate by about 3% in order to enhance the tax revenues. There is a caution for Pakistan's economy that our tax to GDP ratio is very low among the other nations of the world. The government may take other appropriate measures to enhance the tax base, thereby bringing the maximum number of tax evaders under the tax net to increase the tax revenues. It is imperative that each citizen of this homeland should meet his or her tax obligation. Support of the whole nation is essential for the success of any initiative of tax reforms and administration. We cannot deny the fact that the tax base should be broadened for improvement in the fiscal position of any country. The government should adopt improved tax policies, thereby ensuring protection for the poor and vulnerable. The economy should be well documented to improve the tax structure and mitigate the fiscal deficit.

Conflicts of Interest

The authors declare no conflict of interest.

REFERENCES

Bachvarova, E.S., 2008. The debt Laffer curve: estimates for 1990-2005. Thesis submitted to Duke University Durham, North Carolina, United States America. pp 1-62.

Bender, B., 1984. An analysis of the Laffer curve. Econ. Inq. 22, 414–420.

Bunescu, L., Comaniciu, C., 2013. Graphical analysis of Laffer's theory for European Union member states. Ann. Ser. 2, 16-23.

Chakraborty, L., 2015. Fiscal seigniorage "Laffer curve effect" on central bank autonomy in India. Natl. Inst. Public Financ. Fisc. Policy New Delhi 2015–2156.

De Oliveira, F.G., Costa, L., 2015. The VAT Laffer curve and the business cycle in the EU27: an empirical approach. Econ. Issues 20, 29-43.

Dougherty, C., 2016. Introduction to econometrics. Oxford university press, USA.

Fullerton, D., 1983. Can tax revenues go up when tax rates go down?, in: the supply-side solution. Springer, pp. 140–157.

Gahvari, F., 1989. The nature of government expenditures and the shape of the Laffer curve. J. Public Econ. 40, 251–260.

Griffiths, W.E., Hill, R.C., Judge, G.G., 1993. Learning and practicing econometrics. John Willey and Sons. Inc. New York, USA. 11, 331-333.

Gujarati, D.N., 2009. Basic econometrics Tata McGraw-Hill Education.

Hairault, J.-O., Langot, F., Sopraseuth, T., 2005. A quantitative investigation of the laffer curve on the continued work tax: the French case. Available SSRN 673447.

Holter, H.A., Krueger, D., Stepanchuk, S., 2014. How does tax progressivity and household heterogeneity affect Laffer curves? National Bur. Eco. Res. 10, 1317-1356.

Hsing, Y., 1996. Estimating the Laffer curve and policy implications. J. Socio. Econ. 25, 395–401.

Isakov, K., Pekarski, S., 2015. Financial repression and Laffer curves. High. Sch. Econ. Res. Paper. No. WP BRP 113.

Latif, M.I., Rahman, H., Ahmad, H., Ahmad, F., Khurshid, M.M., Shafique, M.N., 2019. Estimation of Laffer curve: evidence from Pakistan. Sarhad J. Manag. Sci. 5, 103–112.

Lin, B., Jia, Z., 2019. Tax rate, government revenue and economic performance: a perspective of Laffer curve. China Econ. Rev. 56, 101307. DOI:10.1016/j.chieco.2019.101307.

Lucas Jr, R.E., 1990. Supply-side economics: an analytical review. Oxf. Econ. Pap. 42, 293–316.

Meyer, L.H., 2012. The supply-side effects of economic policy. Springer science & business media.

Nutahara, K., 2013. Laffer curves in Japan, The Canon institute for global studies. CIGS working paper series13-007E.

Pastor-Barriuso, R., Guallar, E., Coresh, J., 2003. Transition models for change-point estimation in logistic regression. Stat. Med. 22, 1141–1162.

Smith, A., 1776. The wealth of nations. Reprinted, New York: Modern Library, 1937

Takáts, E., Papp, T.K., 2008. Tax rate cuts and tax compliance. The Laffer curve revisited. Available SSRN 1087186.

Tatu, Ş., 2014. An application of debt Laffer curve: empirical evidence for Romania's case. Rom. J. Fisc. Policy 5, 29–38.

Team, R.C., 2020. R: A language and environment for statistical computing. R: Foundation for statistical computing, Vienna, Austria. CSI 019 , WAT 002.

Tucker, I., 2010. Economics for today. Nelson Education. Available at au.cengage.com/c/isbn/9781337613040/

Uhlig, H., Trabandt, M., 2011. How far are we from the slippery slope? the Laffer curve revisited. J. Monet. Econ. 58, 305–327

Van Ravestein, A., Vijlbrief, H., 1988. Welfare cost of higher tax rates: An empirical Laffer curve for the Netherlands. Economist (Leiden). 136, 205–219.